



Influence of carburizing and nitriding on failure of gears – A case study

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Received 12 July 2004; accepted 20 February 2005

Available online 13 September 2005

Abstract

Designing of mechanical parts covers many basic aspects of mechanical engineering. Coupling a proper choice of material and surface treatment, the static and the dynamic designing follow well consolidated criteria, often suggested by experience or prescribed by standards.

In gear design many efforts are planned to extend life against wear and contact fatigue, hence the main role is played by a proper selection of surface hardening methods. Complex phenomena of failure are involved for such components during their working life, therefore a deeper comprehension of the damaging mechanisms is necessary to prevent them.

To this aim a particular case of failure analysis of a pinion gear is considered. It was built in 18NiCrMo5 UNI 7846 case-carburized, quench hardened and tempered steel. By very few working cycles, the transmission gear prematurely failed. Several ruptures on teeth were noticeable to the unaided eye which covered either a small area of the tooth flank (near the root fillet) or a large zone of the flank itself. In any case, the failure involved only upper part of the pinion teeth. A detailed investigation was needed to clarify the reasons of such a premature rupture. The root of failure was determined to be external overloading and the initial stage of the damage was close related to complex surface contact fatigue mechanism.

Following on this investigation the effect of carburising was studied in relation to the mechanism of failure and an alternative nitriding treatment was considered to solve this problem.

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Keywords: Fatigue; Gear-tooth failures; Surface finish; Carburization; Nitriding

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